

# ENVIRONMENTAL IMPACT ASSESSMENT

## Abaco Club Investments LLC

FOR

## MEMBERS DOCKING FACILITY

Little Harbour

Great Abaco

The Bahamas

SUBMITTED ON BEHALF OF:

**Abaco Club Investments LLC**

TO: THE MINISTRY OF THE ENVIRONMENT  
THE BEST COMMISSION

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## **1 EXECUTIVE SUMMARY**

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The Islands of The Bahamas form a 100,000 square mile archipelago that extends over 500 miles from the northwest to the south east. The Bahamas is nestled between the eastern coast of Florida and northern coast of Cuba, and comprises over 700 islands including uninhabited cays, islands, and islets. The Abaco Islands lie in the northern Bahamas and comprise the main islands of Great Abaco and Little Abaco, together with the smaller Elbow Cay, Lubbers Quarters Cay, Green Turtle Cay, Great Guana Cay, Castaway Cay, Man-o-War Cay, Stranger's Cay, Umbrella Cay, Walker's Cay, Little Grand Cay, and Moore's Island. Administratively, the Abaco Islands constitute seven of the 31 Local Government Districts of the Bahamas: Grand Cay, North Abaco, Green Turtle Cay, Central Abaco, South Abaco, Moore's Island, and Hope Town. Towns in the islands include Marsh Harbour, Hope Town, Treasure Cay, and Coopers Town.

### **History**

The Abaco Islands were first inhabited by the Lucayans. The first European settlers of the islands were Loyalists fleeing the American Revolution who arrived in 1783, as was also the case at Cat Island. These original Loyalist settlers made a modest living by salvaging wrecks, by building small wooden boats, and by basic farming.

In the summer of 1783 about 1500 Loyalists left New York and moved to Abaco. They planned and built the town of Carleton, probably present day Hope Town. Disputes over food distribution led some of these settlers to found a rival town at Marsh Harbour. Conflict between disgruntled settlers and the officials responsible for helping became a constant feature of life on the islands. Sea island cotton was first sown by the settlers in 1785 and although both 1786 and 1787 produced good crops, the 1788 crop was blighted by caterpillars. Other settlements on the islands were Green Turtle Cay, Man-o-War Cay, and Sandy Point.

### **Little Harbour**

Little Harbour is 30 miles south of Marsh Harbour, on the Abaco mainland, off the Great Abaco Highway. The settlement is thought to have been founded by a Canadian, Randolph Johnston a longtime professor at Smith College in Northampton, Mass, arriving at Little Harbour, accompanied by his wife Margot their daughter (name) , and three sons, Bill, Pete and Denny in the early 1950's. Little Harbour enjoys a protected harbour but has no municipal services.

### **Botanical Impacts**

Botanical field studies were conducted on 14 November 2014, to map vegetation types, determine floristic diversity, record protected species abundance and identify the presence of invasive species.

Vegetation types were mapped via aerial photography examination and then verified through ground-truthing. The botanical assessment identified three (3) vegetation types that were recorded during the survey: Rocky Shore, Dry broadleaf evergreen formation and human altered.

The botanical survey revealed the site is mainly humanly disturbed, vascular plant diversity is considered low but not unexpected given the relatively small sample area and lack of diverse vegetation cover classes. Additionally, harsh environmental conditions such as salt spray and wind pruning limit botanical diversity.

### **Marine Impacts**

Benthic survey of the proposed “Members Docking Facility” at Little Harbour in South Abaco, Bahamas concluded on November 25, 2014. Twenty different species were observed in this survey with the typical variety and overall numbers associated with a “Seagrass Meadow” community in the Bahamas.

Numerous areas displayed evidence of scouring by boat and prop wash with little benthic flora in these areas, specifically around existing dock structures and mooring buoys. The near shore communities (from shore line out to 4 feet in depth) had a higher density of sea grass cover in the range of 60% by area. A decision was made that no dredging will be conducted either in the existing entrance channel or at the docking facility

Overall long-term biological impacts are anticipated to be minimal with the loss of habitat only in the immediate footprint of the piles. Impacts to the marine environment are anticipated to be minimal and short-term.

### **Recommendations**

The following recommendations are based on the assessment of impacts, short-term and long-term, to this project site at Little Harbour. The proposed recommendations include:

- a) Environmental Management Plan (EMP). An EMP will be prepared as a separate document. The developer should employ best management practices during construction activities including practices that prevent erosion and sediment runoff, ensure proper material storage and disposal, and monitoring of construction of activities during pile installation. As dredging will be required for safe passage to the proposed dock, best management practices for the management of suspended sediment shall be included.

- b) Removal of invasive species. This EIA strongly recommends phased removal of all *invasive and pioneer* species on site by the developer. To maintain the site as exotic-free once invasive species are removed, a long-term maintenance program is necessary. Periodic removal of *Casuarina equisetifolia* saplings from beach areas and undeveloped parcels will assist in preventing the reestablishment of these species.
- c) Limited construction footprint. Given the site's low acreage and humanly impacted environment, limited clearing beyond that which exists is recommended.
- d) Native landscaping. Landscape design should incorporate indigenous plant material. Indigenous species are tolerant to the stresses of a coastal tropical climate and act as resource for food or habitat to local animal species. Use of indigenous plants will help to reduce water demand, particularly those species with drought-tolerance. Native plant species, particularly fruiting shrubs and trees, provide a source of food for resident and migrant avifauna species.
- e) Alternative Energy Sources. Little Harbour is ideal for the introduction of alternative sources, namely, passive solar and photovoltaic array. It is recommended that conventional energy sources, diesel and gas, be supplemented by alternative energy sources or achieved by high efficiency standards.
- f) Reduction of waste and land-based pollution. Limiting the production of land-based waste through recycling, composting, and incineration, reduces the transportation of waste items to local landfills which are under capacity pressure.

## **Conclusion**

This Environmental Impact Assessment for Members Docking Facility at Little Harbour recommends moving forward with the proposed development and finds no significant impact. The site will experience no further loss of vegetation; however, implementation of mitigation techniques such as native landscaping and close construction footprint shall lessen overall impacts.

Additionally, the capital investment will positively impact the local community of Marsh Harbour and Little Harbour by providing employment and occupational transfer of skills while expanding the touristic offerings of Little Harbour. The developer emphasizes a local Bahamian workforce with minimal environmental impacts through the use of renewable energy technology, smart building design, and high efficiency products.

## **2 PURPOSE AND SCOPE**

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The purpose of this report is to assess the environmental impacts associated with the development of the members docking facility at Little Harbour, Abaco, The Bahamas and to recommend measures for minimizing, avoiding, negating, or mitigating of potential impacts when feasible.

This report is to encompass terrestrial and marine areas that could be affected by the proposed docking facility. Thereby, the scope is limited to the project and its area of influence which herein is defined as the 'Site'. The studies are conducted within the Environmental Impact Assessment (EIA) guidelines provided by the Bahamas Environmental Science and Technology Commission (BEST) some of which may not apply to the Site and may be either omitted from this report or stated as non-applicable herein.

Terrestrial and marine benthic areas were surveyed for the purposes of assisting in the decision-making and impact assessment of the proposed docking facility. The terrestrial survey work effort was conducted to identify botanical and avian species to determine recognized land cover classifications within the limits of the investigation site. The terrestrial assessment was performed November 14<sup>th</sup> 2014 and the benthic assessment was concluded on November 25<sup>th</sup> 2014.

### 3 PROJECT DESCRIPTION

Little Harbour is located approximately ninety miles north-northeast of the capital Nassau, New Providence. The natural protected harbour has a footprint of approximately twenty three acres and is fringed with single family residences. Little Harbour is well known for the Foundry and Pete’s Pub which attract both residents and guests alike.



**FIGURE 3.1 – Location Plan – ABACO**

The members docking facility will be built on a parcel of land that was previously in ownership by the Marriott Group for a number of years (please refer to Figure 3.4 – Members Docking Facility), the terrestrial footprint of the property is .63 acres and bisected by the access road to Pete’s Pub.

The benthic area which is to be the subject of a seabed lease is approximately two acres. The upland

section contains an existing two storey wooden structure at the harbour which is to be retained together with adjoining support structures the area has previously landscaped and is to be considered humanly disturbed there are a number of pioneer / invasive species (please refer to section 4.4.1.6 for further details). Select wood structures to the south of the road are to be demolished.



Figure 3.2 – Abaco Magisterial Districts and Little Harbour Location Plan

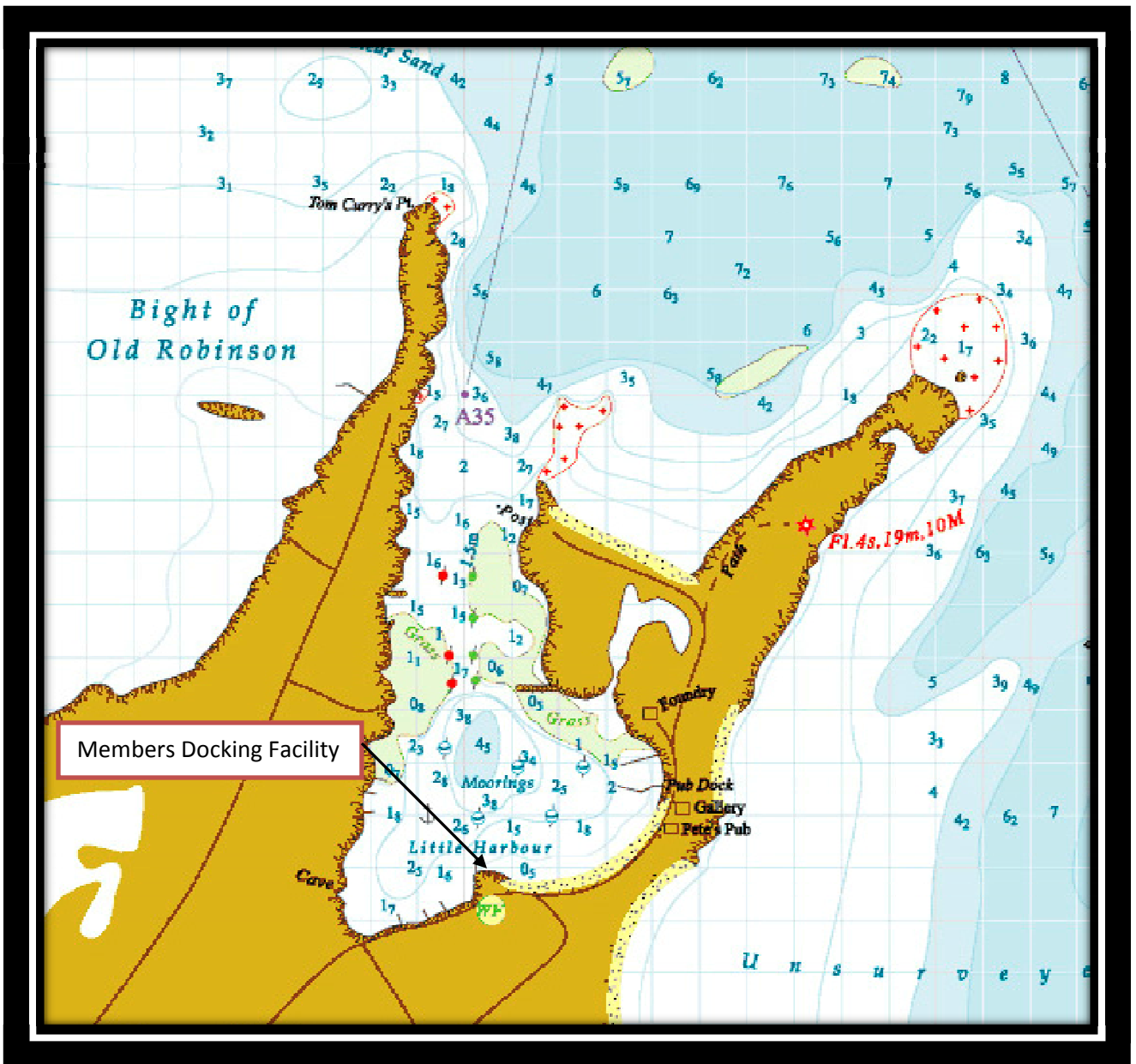
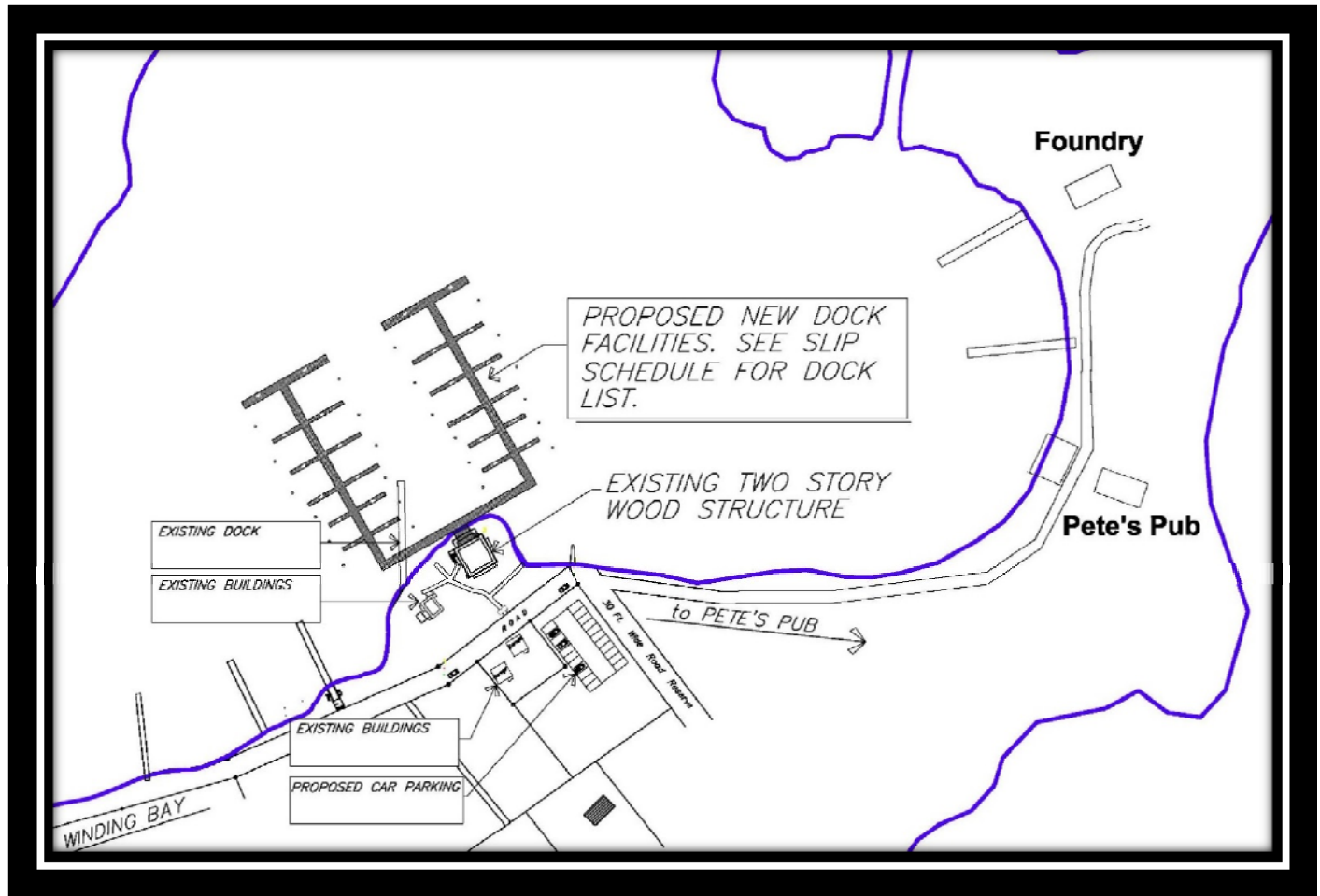


Figure 3.3 Project Location Plan



**Figure 3.4 Members Docking Facility**

### 3.1 Detailed Project Description

The Members Docking Facility is intended to provide docking facilities for Winding Bay members, facilities that are currently not available nor feasible at Winding Bay. The existing two storey wooden structure will be maintained with minimal upgrades to provide upland facilities for the members utilizing the dock spaces. There is to be a planned removal of invasive and pioneer species but no further development is anticipated north of the existing road.

South of the road there are select wood structures that are to be relocated. It is proposed that a covered parking area will be provided for members and staff parking. The structure will be so designed that this may serve as a support structure for a photovoltaic array. (Please refer to Figure 3.4 Members Docking Facility) for a general arrangement and layout.

It is proposed to demolish the existing docks associated with this property and replace with forty four slips as depicted on **Figure 3.4 Members Docking Facility**. The proposed fleet mix will comprise the following;

- 4 # Slips 25 feet x 60 feet
- 4 # Slips 25 feet x 50 feet
- 8 # Slips 20 feet x 60 feet
- 8 # Slips 20 feet x 50 feet
- 10 # Slips 15 feet x 40 feet
- 10 # Slips 15 feet x 30 feet

Total 44 slips

## **3.2 Phasing**

Complete build-out of the members docking facility is proposed to be completed in a single phase.

## **3.3 Alternatives**

### **3.31 The 'No Action' Alternative**

The 'No Action' alternative would keep the Site 'as is' and would prevent the construction of the proposed Docking facility and its associated structures and amenities, including docks, thereby limiting Winding Bay Members enjoyment of the property. The likely economic stimulus to Little Harbour, being gained in increased investment, would be lost.

The Site would continue to undergo natural, biological, and physical processes. Social, cultural, and economic factors will continue to influence the ongoing development of the other properties and lands of the Little Harbour area.

## 4 ENVIRONMENTAL BASELINE

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### 4.1 Geographical Location

The proposed members docking facility is to be located within the existing footprint of Little Harbour on a parcel of land that is in the ownership of Winding Bay (**Please refer to Figure 3.3 Location Plan**)

### 4.2 Land Use

The current upland land use has one residential structure. North of the access road that bisects the property is to be considered humanly disturbed (FLUCCS 7240). The parcel contains a two storey wooden structure and a car port. The site has been landscaped but contains native mature specimens that are to be retained.

South of the access road the area is also to be considered humanly disturbed the area has a larger proportion of invasive and pioneer species that are later described in section 4.4.1.6. This area has some derelict wooden structures that are to be demolished. All invasive species are to be removed.

### 4.3 Physical Aspects

#### 4.3.1 Climate

The Abaco Island Group is located in the northern Bahama Archipelago. As such, its climate is on average wetter and cooler than that experienced in the central and southern Bahamas. The weather in Abaco is generally consistent throughout the changing seasons. The summer months consists of gentle trade winds, but warm temperatures. It is common for isolated thunderstorms to come and go quickly during the months of May through September. The winter months are quite comfortable and generally pretty warm, with the exception of cold fronts, which make their way over from Florida.

#### 4.3.2 Air Temperature

The Bahamas has been described as “having a tropical maritime wet and dry type climate with winter incursions of modified polar air” (Bahamas Department of Meteorology, 2005). Winter temperatures are lower than New Providence in the northern Bahamas while the southern Bahamas experiences

temperatures 5 degrees higher during summer months (Bahamas Department of Meteorology, 2005).

#### 4.3.3 Sea Surface Temperature

Sea surface temperature normally varies between 74°F in February and 83°F in August. The following table depicts average monthly sea surface temperatures for Abaco:

Average <b>Monthly</b> Temperatures (air and water)			
<b>Month</b>	Air Temp- Average High	Air Temp - Average Low	Average Water Temp
January	77°F	66°F	70°F
February	77°F	65°F	71°F
March	78°F	67°F	74°F
April	81°F	69°F	76°F
May	82°F	70°F	79°F
June	82°F	70°F	80°F
July	87°F	75°F	85°F
August	88°F	76°F	86°F
September	88°F	75°F	85°F
October	84°F	74°F	82°F
November	81°F	71°F	79°F
December	79°F	67°F	74°F

#### 4.3.4 Rainfall

The Bahamas experience a wet and dry season typical of a maritime subtropical climate. The rainy season typically starts in mid-May and extends to mid-October followed by the dry season (Sealy, 2006).

Throughout the northern Bahamian Island Group rain showers occur any time of the year, but the typical rainy period occurs from May to October. In Abaco, monthly rainfall averages 3.5 inches. The following table depicts average monthly rainfall for Abaco:

January	2"
February	1.6"
March	1.4"
April	1.6"
May	4.3"
June	4.3"
July	3.8"
August	4.4"
September	6.2"
October	7.4"
November	2.6"
December	2.2"

#### 4.3.5 Winds

Cooled by the prevailing southeasterly Tradewinds in the summer and warmed by the surrounding waters and the Gulfstream in the cooler months, The Abacos are rarely uncomfortably hot or cold. Although the central Abacos are on the same latitude as Palm Beach, Florida (27°45'), the winter temperatures average 10° (F) warmer than Florida and the summer highs are generally somewhat lower than those found on similar Florida latitudes due to the moderating effects of the surrounding waters. As a matter of record, the average daily highs and lows rarely differ by more than 12 degrees (F), with monthly rainfall averaging about 2 inches in the winter and 6 inches in the summer, primarily in the "20-minutes-and-they're-gone" afternoon showers and squall lines.

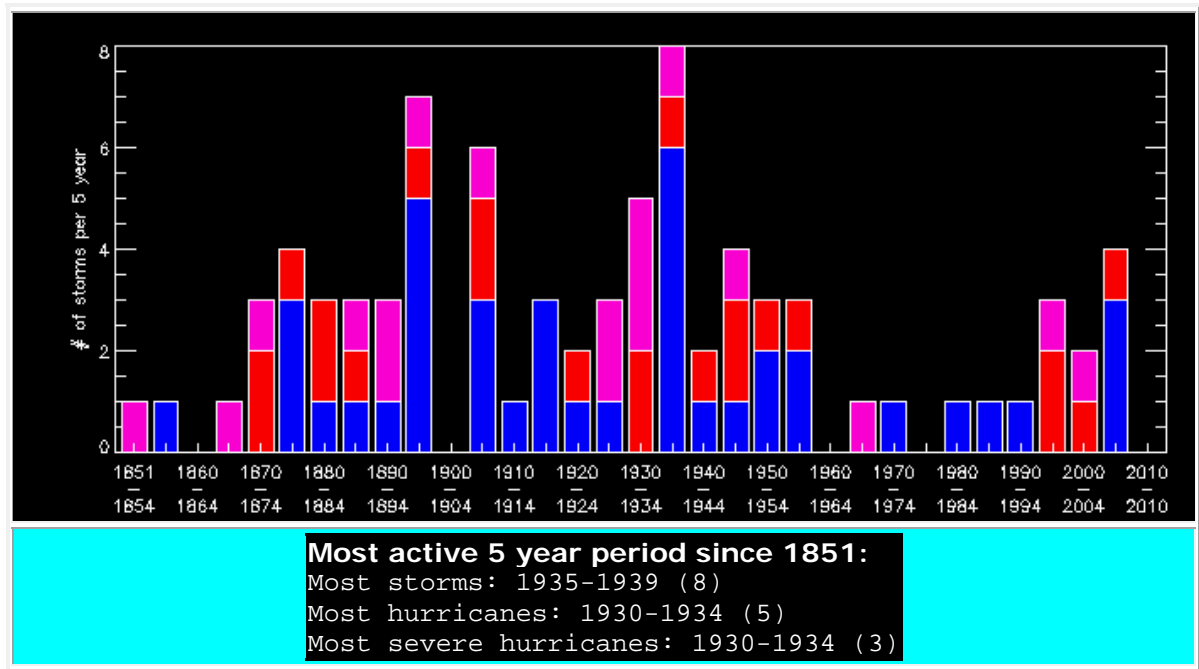
According to Bahamian meteorological records, The Abacos experience an average of more than seven hours of sunlight per day.

#### 4.3.6 Hurricanes

The official Atlantic hurricane season starts June 1st and ends November 30th, although hurricanes can, and often do, form outside of these dates. Typically, hurricane activity tends to increase during the months of August through October.

## Period: 1851 - 2010

category 3-5 hurricanes: purple; category 1-2: red; tropical storms: blue



The Bahamas lay within the Atlantic hurricane belt where hurricane activity is a regular occurrence for this region of the world. Hurricane season extends from June 1 to November 30. Statistics show the Bahamas is in the path of hurricanes with historically more than 50 tropical cyclones of hurricane intensity passing within 125 miles of Nassau between 1886 and 1999 (Bahamas Department of Meteorology, 2005). The Bahamas experienced direct impacts from Hurricanes Andrew (1992), Floyd (1998), Michelle (2001), Frances and Jean (2004), Irene (2011) and Sandy (2012).

Little Harbour may expect to be brushed or hit every 1.78 years and may experience hurricane hits with hurricane force winds every 3.64 years. The area was last impacted by Hurricane Sandy on October 26<sup>th</sup> 2012.

Hurricane watches and warnings will provide advance notice to residents and visitors to the Members docking facility for evacuations or preparations.

New structures will be built to endure winds of up to 140 miles per hour as per the hurricane construction standards of the Bahamas Building Code Edition III.

### 4.3.7 Tides

Astronomical tides in the site vicinity are semidiurnal with mean range of approximately 2.6 feet and average spring range of approximately 3.3 feet. In the central Bahamas the tide range is approximately 2.6 feet. Tides for Little Harbour are derived from Pelican Harbour tide station located at N 26°23', W 076°58' located as depicted in Figure 3.4.3.2

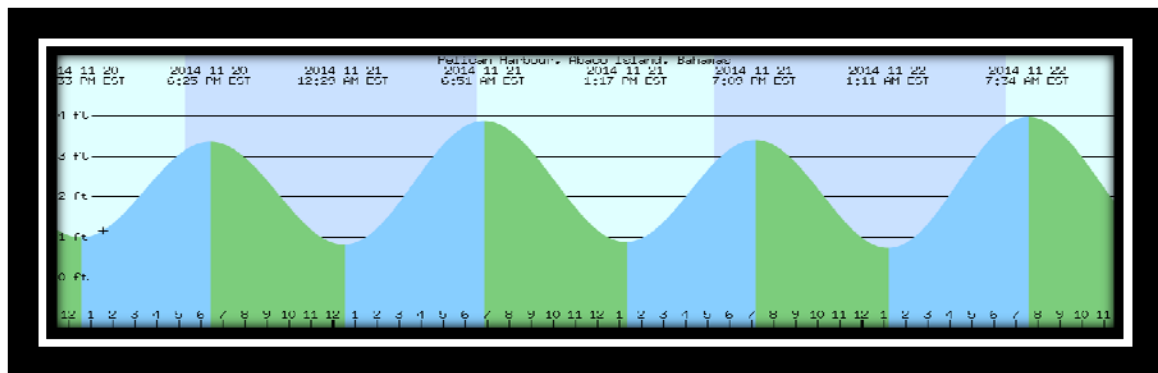


Figure 3.4.3.1 Typical Tides for Little Harbour

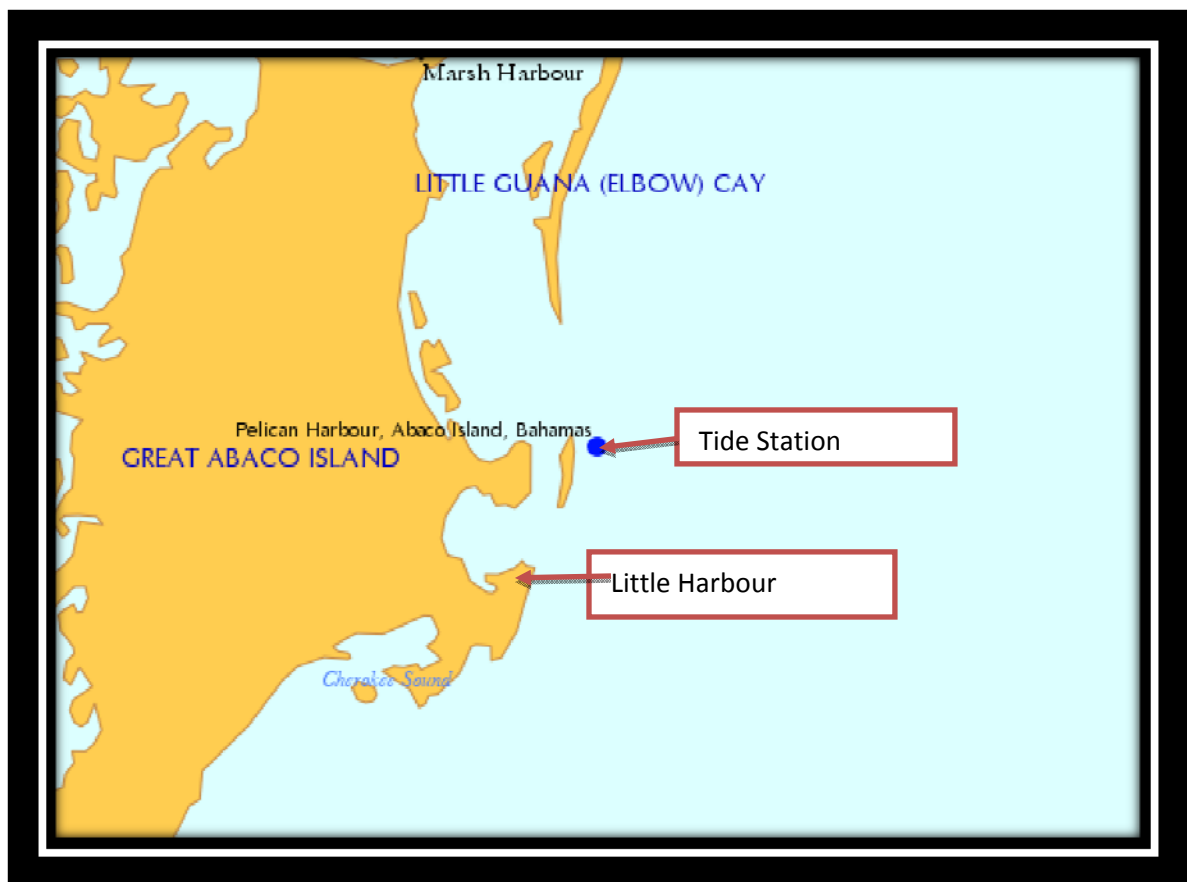


Figure 3.4.3.1 Pelican Harbour Tide Station

#### 4.3.8 Littoral

Little Harbour being enclosed save for a shallow entrance does not experience any significant littoral transport, there is a minimal pocket beach on the southern coastline within the harbour. The construction of the proposed docks will not negatively impact any littoral transport systems.

#### 4.3.9 Topography

The Bahamas is comprised of an extensive archipelago of carbonate islands and shallow banks thought to have formed less than 200 million years ago (Sealy, 2006). The topography of the Bahamas is generally flat with occasional coastal ridges. The Abaco's, like many Bahamian islands, was formed from an accumulation of calcium carbonate sediments through chemical precipitation of oolite and deposition of skeletal components of marine flora and fauna. A subsequent drop in sea level exposed these sediments, which underwent lithification converting the sediments into limestone rock.

The topography of Little Harbour is likely typical of many Bahamian islands, in that it too resulted from the evolution of a series of coastal sand dunes which solidified to form dune rock and coastal ridges.

The site experiences a rapid escalation in elevation from the Harbour towards the west coastal ridge with heights of over forty feet.

#### 4.3.10 Hydrological and Hydrogeographical Resources

No site specific geotechnical investigation has been carried out as part of this study and report due to the invasive and destructive impact that this requires however, the following general discussion is held to be relative to the site under discussion. The following important types (in some cases specific to a certain depth) can be identified in the geological sequence of the Bahamas.

##### **Uncemented Loose Sands**

These are the sands (mostly Holocene in age) described from many coastal areas. Uncemented sands, particularly fine-grained ones, are highly porous but because the pores are very small, surface tension is high and this allows little groundwater movement. Despite their relative impermeability they can, because of their water-retaining ability, store freshwater even in close proximity to the sea. Most limestone in a similar situation would, because of their greater permeability, retain their freshwater less well. Consequently, fresh groundwater on a small cay is more likely to be found in sandy areas than among rocks. The sands east of Governor's Harbour, Eleuthera, exemplify the value of fine-grained sands as an aquifer – even though their low permeability causes abstraction problems and wide dug wells

replace boreholes, whose low yield would rapidly cause them to be pumped dry.

## **Marine Deposits**

Marine deposits +15 feet above to -20 feet below msl are rock units that exhibit a wide range of cementation, cementation being the first important diagenetic step in the change from loose sand to fully altered rock. Initially, cementation reduces porosity by filling vacant space between grains. However, water movement continues through holes etched out by water penetrating into depositional burrow structures, roots, casts and bedding planes. Further cementation of the mass is accompanied by increased flows through so called 'secondary porosity' which occurs due to a connected system of 1/3 - 3/4 inch wide fissures and holes etched out by solution of the rock. The denser and more resistant the mass of rock becomes to groundwater movement, the more these channels develop. Channels which conduct a high proportion of the water moving through the rock are often lined with a red-stained coating of calcite. Channels not actively involved in water movement soon become filled with coarse granular calcite crystals, calcite being one of the pure crystalline forms taken by limestone.

At approximately 8-10 ft. below msl in the uppermost marine deposit, there is a moderately widespread zone of ancient soils and crusts of harder-rock. This zone may have hydrologic importance, especially as it occurs at what is commonly the base of many supply wells. In practice, these uppermost units are usually the only portion of the aquifer from which water is directly abstracted and have a higher porosity, though a lower permeability (connected porosity) than the underlying rocks. This has now been demonstrated by a gamma-ray assessment of the core specimens by the University of Miami. With notable exceptions, most of the cores have a constant porosity of 40-50% in the uppermost 20 foot range. These figures are important in evaluating the total volume of freshwater in any area.

## **4.4 Biological Baseline**

### **4.4.1 Terrestrial Survey:**

Field studies were conducted on 14 November 2014, to map vegetation types, determine floristic diversity, record protected species abundance and identify the presence of invasive species.

#### **4.4.1.1 Methodology:**

Vegetation types were mapped by walking throughout the limits of the site. Vegetation Type taxonomy are based on Arces et al. (1999). A floral list was compiled by recording vascular plant species during the ground truthing exercise. Plant Taxonomy is based on Corell and Corell (1982). The presence, location and abundance of vascular species listed under the Conservation and Protection of the Physical Landscape Act, Protected Trees Order (1997) and the BEST Commission, National Invasive Species

Strategy for The Bahamas, 2003 were noted when encountered.

#### 4.4.1.2 Vegetation Types:

Three (3) vegetation types were recorded during the survey: Rocky Shore, Dry broadleaf evergreen formation and human altered.

#### 4.4.1.3 Rocky Shore

Rocky shore was observed at two locations within the survey limits. In the first instance it occurred as a thin band below a Dry broadleaf evergreen formation along an elevated shoreline. A few individuals of *Rhachicallis americana* (Sandflybush) was the only vegetation present among the exposed rock.

Rocky shore was also present along the sea level shoreline. In this instance *Conocarpus erectus* (Buttonwood) at a height of 15' was the most common species. Two (2) individuals of Red Mangrove (*Rhizophora mangle*) propagules was present and established. Other species present included, *Euphorbia mesembrianthemfolia* (Coast spurge), *Sesuvium portulacastrum* (Sea Purslane) *Borrchia arborescens* (Bay Marigold), and *Argusia gnapholodes* (Bay lavender).

It should be noted that a significant amount of sea weed was accumulated along this Rocky shore.



Rocky shoreline with Buttonwood (*Conocarpus erectus*) and sea weed deposit



Red Mangrove seedlings along Rocky shore

#### 4.4.1.4 Dry Broad-Leaved Evergreen Formation

Dry broadleaf evergreen formation (DBEF) was present along the elevated rocky shoreline in two patches; one at the location for the proposed dock entrance and the other immediately to the east this location. The vegetation in these areas extends no more than 15' in depth and 30' in length. Vegetation height is 10-15' and include *Coccothrinax argentata* (Thatch Palm), *Metopium toxiferum* (Poisonwood), *Jacquinia keyensis* (Joewood), *Erithalis fruticosa* (Black torch) and *Casasia clusiifolia* (Seven year apple).



Patch of DBEF at entrance of proposed dock



Patch of DBEF to east of entrance of proposed dock

#### 4.4.1.5 Human Altered

Approximately 95% of the site has been previously cleared and human altered. Human altered areas have a ground cover of *Zoysia sp.* grass as the dominant ground cover species. Because of the aggressive growth habit of the *Zoysia* grass there is no distinct shrub layer, instead there are patches and isolated occurrences of seedlings and small shrubs of native species such as *Plumeria obtusa* (Wild Frangipani), *Metopium toxiferum* (Poisonwood), *Lantana involucrata* (Small leaf sage) and *Turnera ulmifolia* (Buttercup). There is also no distinct and consistent canopy layer but rather spotted occurrences of trees

such as *Cocos nucifera* (Coconut), *Swietenia mahagoni* (Mahogany) and *Conocarpus erectus* (Buttonwood) that were left in place during clearing or intentionally planted as solitary species. There are a number of ornamental species such as *Pandanus sanderi* (Variegated Screw Pine), *Dracena sp.* (Dracena), *Hibiscus sp.* (Hibiscus), *Cycas revoluta* (King Sago Palm) and *Acalypha wilkensisiana* (Match me if you can) that were planted for beautification.

A number of buildings are also present within the human altered areas.



Human Altered area in proposed location for car park



Human Altered Area near existing and proposed Club House location

#### 4.4.1.6 Invasive Species:

Six (6) invasive species were observed on the sites (see table below).

Botanical Name	Common Name	Status*		Presence on site
		E	C	
<i>Scaevola taccada</i>	White Inkberry	√		Large patch near proposed car park area and a few isolated species within the Human altered areas
<i>Casuarina equisetifolia</i>	Australian Pine		√	A few mature species are present as solitary species throughout the human altered areas on the site
<i>Leucaena glauca</i>	Jumbey		√	Present along the edges of the human altered areas on the site
<i>Wedelia trilobata</i>	Carpet daisy		√	A small patch in the human altered area near the proposed car park
<i>Terminalia catappa</i>	West Indian Almond		√	One individual in the Human altered area near the club house
<i>Jasminum fluminense</i>	Jasmine vine		√	Present in one location in the human altered area near the proposed car park

\* - Recommendations from BEST Commission, National Invasive Species Strategy for The Bahamas, 2003

E – Eradication

C - Control



Large patch of *Scaevola taccada* (White Inkberry)

#### 4.4.1.7 Protected Tree Species Survey

Two (2) protected species was observed during the investigation *Swietenia mahagoni* (Mahogany) and *Guapira discolor* (Beefwood). Several large *Swietenia mahagoni* (Mahogany) trees are present as solitary Species in the Club House area. And one (1) individual of *Guapira discolor* (Beefwood) was present in the Dry Broad –Leaved Evergreen Formation vegetation type.

#### 4.4.1.8 Vascular Plant Diversity

Fifty two (52) species were recorded during the investigation (see table below). It is unlikely that all of the species present on the site are represented in this report as data collection was limited to a single field study, however, given the highly disturbed state of the site it is doubtful that any significant amount of additional species is present. Plant species recorded included a combination of ornamental, invasive and native species. The human altered areas were primarily ornamental species as the presence of the *Zoysia sp.* ground cover limited the reestablishment of native species. The Rocky shoreline and Dry broadleaf evergreen formation areas however were almost exclusively native species.

## List of Plant Species recorded during survey

Botanical Name	Common Name	Location					
		Area			Vegetation Type		
		CP	CH	DE	RS	DBEF	HA
<i>Acalypha wilkensis</i>	Match me if you can	√					√
<i>Agave sp.</i>	Agave	√					√
<i>Argusia gnapholodes</i>	Bay Lavander				√		
<i>Beaucarnea recurvata</i>	Ponytail		√				√
<i>Bidens alba</i>	Shepherd's needle	√					√
<i>Borrchia arborescens</i>	Bay Marigold				√		
<i>Bursera simarouba</i>	Gum Elemi	√					√
<i>Canavalia rosea</i>	Bay bean				√		
<i>Carissa macrocarpa</i>	Natal Plum		√				√
<i>Casasia clusiifolia</i>	Seven year apple		√			√	√
<i>Cassytha filiformis</i>	Love vine						
<i>Casuarina equisetifolia</i>	Australian Pine	√					√
<i>Coccoloba uvifera</i>	Sea grape	√	√		√	√	
<i>Coccothrinax argentata</i>	Silver top Palm		√			√	
<i>Cocos nucifera</i>	Coconut Palm	√					√
<i>Conocarpus erectus</i>	Buttonwood	√			√	√	√
<i>Cordia sebestena</i>	Geiger Tree		√				√
<i>Cycas revoluta</i>	King Sago Palm	√	√				√
<i>Dracena sp.</i>	Dracena	√					√
<i>Drypetes diversifolia</i>	White wood					√	
<i>Echites umbellata</i>	Wild potato	√	√			√	√
<i>Encyclia sp.</i>	Orchid		√				√
<i>Erithalis fruticosa</i>	Black torch					√	
<i>Ernodea littoralis</i>	Beach Creeper				√		
<i>Eugenia axillaris</i>	White stopper	√					√
<i>Eugenia foetida</i>	Spanish Stopper	√					√
<i>Eupatorium villosum</i>	Jackmada	√					√
<i>Euphorbia mesembrianthemifolia</i>	Coast spurge				√		
<i>Ficus sp.</i>	Fig		√			√	√
<i>Guapira discolor</i>	Beefwood					√	
<i>Hibiscus sp.</i>	Hibiscus	√					√
<i>Hymenocallis arenicola</i>	Spiderlily	√					√
<i>Jacquinia keyensis</i>	Joewood				√		
<i>Jasminum fluminense</i>	Jasmine vine	√					√
<i>Lantana involucrata</i>	Small leaf sage	√	√			√	√
<i>Leucaena leucocephala</i>	Jumbay	√					√
<i>Metopium toxiferum</i>	Poisionwood	√				√	√

Botanical Name	Common Name	Location					
		Area			Vegetation Type		
		CP	CH	DE	RS	DBEF	HA
<i>Pandanus sanderi</i>	Screw Pine	√					√
<i>Passiflora sp.</i>	Passion fruit	√					√
<i>Pluchea odorata</i>	Fleabane		√				√
<i>Plumeria obtusa</i>	Wild Frangipani	√					√
<i>Protasparagus densifloros 'sprenger'</i>	Asparagus fern	√	√				√
<i>Rhachiallis americana</i>	Sandfly bush				√		
<i>Scaevola taccada</i>	White Inkberry	√	√				√
<i>Sesuvium portulacastrum</i>	Sea Purslane	√			√		√
<i>Sporobolus virginicus</i>	Seashore rush grass				√		
<i>Stenotaphrum secundatum</i>	St. Augustine grass	√					√
<i>Swietenia mahagoni</i>	Mahogany	√	√				√
<i>Terminalia catappa</i>	West Indian Almond		√				√
<i>Turnera ulmifolia</i>	Buttercup	√	√				√
<i>Wedelia trilobata</i>	Carpet Daisy	√					√
<i>Zoysia sp.</i>	Zoyzia grass	√	√				√

#### *4.4.1.9 Vegetation Map*



## 4.4.2 Marine Benthic Survey

### 4.4.2.1 Methodology

Benthic survey of the proposed “Members Docking Facility” at Little Harbour in South Abaco, Bahamas conducted on November 25, 2014. The area was subdivided into intersecting transects approximately 100’x100’ overlaid on the existing dock area and proposed. (Reference figure 4.4.2.1) Observations were made along the transect lines to determine benthic cover habitat, marine fauna, and flora. Depth Soundings were also made in both of the survey areas using a handheld fathometer. Reference figure 4.4.2.2 and table 4.4.2.2 for the “Members Docking Facility” and figure 4.4.2.4 and table 4.4.2.4 for the “Channel Entrance”

### 4.4.2.2 Sandy Bottom with Sea Grass

Benthic cover changed consistently from near shore depths of less than 2 feet to the edge of the transect area in depths of 10 feet. The predominant cover was a mixed community of turtle grass (*Thalassia testudinum*) and manatee grass (*Syringodium filiforme*) numerous epiphytic algae were also intermixed. The near shore communities (from shore line out to 4 feet in depth) had a higher density of sea grass cover in the range of 60% by area. The depth zone of 4 feet to 8 feet had a lower density of sea grasses and higher component of algal species. Water depths in excess of 8 feet were predominantly exposed sandy areas, with minimal diatom and algal cover.

### 4.4.2.3 Habitat Utilization

Numerous areas displayed evidence of scouring by boat and prop wash with little benthic flora in these areas, specifically around existing dock structures and mooring buoys. A healthy representation of molluscs were represented in the shallower/higher density sea grass areas, with juvenile queen conch (*Strombus gigas*) the predominant species. Almost all fish species were observed in the area immediately underneath or adjacent to the existing docks, juvenile grunts, snappers, and a barracuda were observed. In the deeper areas just outside the transect areas numerous sub adult turtles (*Chelonia mydas*) were observed breathing at the surface.



Figure 4.4.2.2

Table 4.4.2.2	Marine Soundings		
	Depth		
	MLW		
Point			
1	4.6		
2	2.8		
3	4.0		
4	2.8		
5	5.2		
6	4.5		
7	3.8		
8	4.0		
9	5.7		
10	5.0		
11	7.4		
12	7.0		
13	6.0		
14	6.2		
15	7.8		
16	7.4		
17	8.0		
18	8.0		
19	10.8		
20	10.0		
21	10.3		
22	11.1		

#### 4.4.2.2 Sandy Bottom with Sea Grass



Photo 4.4.2.2



Photo 4.4.2.3



Photo 4.4.2.4

#### 4.4.2.4 Species Diversity

Twenty different species were observed in this survey with the typical variety and overall numbers associated with a “Seagrass Meadow” community in the Bahamas. As observed in the wider local area the seagrass community is an important foraging stop for Green Turtles (*Chelonia mydas*)

**Table 4.4.2.1 Species Diversity**

Genus	Species	Common Name	Findings								
<b>Marine Flora</b>			T1	T2	T3	T4	T5	T6	T7	T8	T9
<b>Algae</b>											
Acetabularia	calyculus	Mermaids Wine Glass						x			
Caulerpa	sp	Green Grape alga				x	x	x	x	x	x
Halimeda	incrassata	Three Finger leaf alga	x	x	x	x	x	x			
Laurencia	sp					x	x	x	x	x	x
Penicillus	sp	Bristle Brush				x	x	x			
<b>SeaGrass</b>											
Syringodium	filiforme	Manatee Grass	x	x	x			x			x
Thalassia	testudium	Turtle Grass	x	x	x	x		x			x
<b>Marine Fauna</b>											
<b>Cnidarians</b>											
Cassiopea	sp							x	x	x	x
<b>Echinoderms</b>											
Oreaster	reticulatus	Cushion Sea Star			x						
<b>Fish</b>											
Abudefduf	saxatilis	Sgt Major					x				

Epinephelus	striatus						x				
Gerres	cinerus		x				x	x			
Haemulon	flavolineatum						x				
Lutjanus	analisis						x				
Lutjanus	apodus						x				
Ocyurus	chrysurus			x			x				
Pomacanthus	paru										
Sphyræna	barracuda						x	x			
<b>Mollusca</b>											
Strombus	gigas				x			x			



Figure 4.4.2.1

#### Channel Entrance:

Sandy area in channel used by vessels demarked by green buoys, depths at buoy shallow grass beds to the end of the green buoy. Reference figure 4.4.2.4 and table 4.4.2.4 below. Numerous sightings of Green Sea Turtles. Evidence of extensive silt plume from dredging working in NE corner of Little Harbour.



Figure 4.4.2.4

Table 4.4.2.4	Marine Soundings		
	Depth		
	MLW		
Point			
1	5.1		
2	4.8		
3	3.2		
4	5.9		
5	5.3		
6	3.5		
7	6.1		
8	5.5		
9	5.0		

## **4.5 National Parks**

Pelican Cays Land and Sea Park located approximately eight miles north of Cherokee Sound, Great Abaco, this 2,100 acre land and sea area established in 1972 is a sister park to the Exuma Cays Land and Sea Park. It contains undersea caves, extensive coral reefs and abounds with terrestrial plant and animal life. Located approximately twenty five miles south is the Abaco National Park, established on May 9, 1994, the Abaco National Park comprises 20,500 Acres in Southern Abaco. Included in this area is 5,000 Acres of pine forest, the major habitat of the Bahama Parrot.

## **4.6 Socio-economic**

### **4.6.1 Population**

The combined population of the Abaco islands is about 17,224 as of 2010, and the principal settlement and capital is Marsh Harbour. The racial make-up is about 50% white and 50% black.

In addition to Marsh Harbour there are several other settlements on Great Abaco including Cherokee Sound, Coopers Town, Crossing Rock, Green Turtle Cay, Hope Town, Little Harbour, Rocky Point, Sandy Point, Spring City, Treasure Cay, Wilson City, and Winding Bay.

Surrounding Great Abaco are several smaller islands known as cays, many of which are popular with tourists visiting the islands. A few notable cays include Castaway Cay (formerly Gorda Cay), Elbow Cay, Tilloo Cay, the Grand Cays, Great Guana Cay, Man-O-War Cay, Green Turtle Cay, Moore's Island, and Walker's Cay.

### **4.6.2 Labour Estimates**

Labour estimates are estimated to be approximately eight persons during the construction phase and a maximum of two persons during the operational phase.

### **4.6.3 Transportation**

Transportation to and from Members Docking Facility will be by vehicle from Winding Bay.

Members and guests will arrive in Abaco at Marsh Harbour International airport which is an international airport with immigration and custom facilities to host frequent flights between Nassau and Florida. All

travel to Winding Bay and Little Harbour will be by road transport.

## **4.7 Cultural Resources**

The subject property at Little Harbour has no known cultural resources. Though not anticipated, should the developer discover relics from a bygone period, the developer shall cease all operations in that area and contact the Antiquities Monuments and Museum Corporation immediately.

## **4.8 Waste Streams**

Management of island waste requires a complete understanding of all sources including solid ‘garbage’ and liquid sewerage.

### **4.8.1 Solid Waste Stream**

Currently there are no municipal waste collection service serving Little Harbour. All municipal solid waste is disposed of to a landfill.

No generation of hazardous waste is anticipated.

### **4.8.2 Liquid Waste Stream**

Little Harbour has no water borne sanitation. All residences together with commercial operations are reliant upon septic systems and drain fields. The existing two storey structure at the Site is served by a septic tank and drain field and it is envisaged that this methodology will continue for the member’s docking facility.

## **4.9 Utilities**

There are no existing public services serving Little Harbour.

### **4.9.1 Electricity**

There is no municipal electricity service in Little Harbour. PV and passive solar are widely used and supplemented by back-up or stand-by diesel generators. The member’s docking facility proposes the

installation of a PV array over a parking structure to be built to the south of the two storey structure. Power to the former residence was by means of photovoltaics.

#### 4.9.2 Potable Water

Like many small cays of the Bahamas, Little Harbour does not obtain freshwater from a public drinking water system or wells. It is apparent that there are no freshwater sources within the project limits due to the limited footprint between the ridge and the Harbour.

The existing two storey structure is built over an existing rainwater cistern said to hold fifty thousand gallons. This cistern will be refurbished and continue as the potable water supply.

#### 4.9.3 Fuel Storage and Distribution

There are no plans for fuel storage at this time. In the event that fuel demands cannot be met from a local source a future application will be made and a supplemental environmental impact assessment (SEIA) will be submitted.

### 4.10 Construction and Materials Source

Limestone sand and limestone rock are locally available, there are a wide selection of locally available building materials in Marsh Harbour while most other construction materials are imported from Florida.

## 5 LEGAL ASPECTS

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### 5.1 Domestic Legislation

Bahamian legislation which pertains to the physical and natural environment and which may pertain to the proposed development is listed as follows:

Title IV	Ch. 18	Consular Relations and Commonwealth Officers Act,
	1969 Ch. 26	Public Works Act, 1964
	Ch. 28	Out Islands Utilities Act, 1965
	Ch. 37	Local Government Act, 1996
	Ch. 51	Antiquities, Monuments, and Museum Act, 1998 Antiquities, Monuments, and Museum Regulations, 1999
Title XIV	Ch. 140	International Persons Landholding Act, 1994
	Ch. 141	The Bahamas Vacation Plan and Time-Sharing Act, 2000 The Bahamas Vacation Plan and Time-Sharing Regulations, 2000
	Ch. 194	Electricity Act, 1956
Title XIX	Ch. 195	Out Islands Electricity Act, 1965
Title XX	Ch. 196	Water and Sewerage Corporation Act, 1976 Water Supply Rules, 1953
	Ch. 197	Water Supplies (Out Islands) Act, 1953 Water Supplies (Out Islands)
Rules Title XXI	Ch. 199	Housing Act, 1968 Housing Regulations, 1983
	Ch. 200	Buildings Regulation Act, 1971 Buildings Regulation (General) Rules, 1971 Building Regulation (Extension to the Out Islands) Order, 1975
	Ch. 201	Roads Act, 1968
	Ch. 204	Coast Protection Act,
	1968 Title XXV Ch. 215	Explosives Act, 1970 Explosives Regulations, 1970
	Ch. 216	Explosive Substances (Illegal Use and Possession) Act,
	1958 Ch. 217	Inflammable Liquids Act, 1958
	Ch. 218	Liquefied Petroleum Gas, Act 1988

	Ch. 219	Liquefied Petroleum Gas Regulations, 1988 Petroleum Act, 1978 Petroleum Regulations, 1978
Title XXVI	Ch. 223	Derelict Motor Vehicles (Disposal) Act, 1967 Ch. 232 Environmental Health Services Act, 1987
Title XXX	Ch. 248	Wild Animals (Protection) Act, 1968
	Ch. 249	Wild Birds Protection Act, 1952 Wild Birds Protection (Reserves) Ch. 250 Plants Protection Act, 1916 Plants Protection Order 1918 Prohibition of the Importation of Plants Order, 1971

		Prohibition of the Importation of Plants (State of California) Order, 1982
		Plants Protection (Import of Citrus Fruits, Plants and Other Propagative Material from Florida) Order, 1993
		Plants Protection (Restriction on Imports of Fruits, Vegetables, Flowers, Plants and other Propagative Materials) Pink Mealybug) Order, 1997
		Plant Protection Rules, 1916
Title XXXI	Ch. 251	Land Surveyors Act, 1975
		Bye-laws of The Bahamas Association of Land Surveyors 1993
		Land Surveyors Regulations, 1975
	Ch. 252	Acquisition of Land Act, 1913
	Ch. 253	Out Islands Dilapidated Buildings Act, 1952
	Ch. 257	Private Roads and Subdivisions (Out Islands) Act, 1965
	Ch. 258	Subdivisions (Local Improvement Associations) Act, 1965
	Ch. 259	Reclamation and Drainage Act, 1937
	Ch. 260	Conservation and Protection of the Physical Landscape of The Bahamas Act, 1997
		Declaration of Protected Trees Order, 1997
		Conservation and Protection of the Physical Landscape of The Bahamas Regulations, 1997
	Ch. 270	Abutments Act, 1864
	Ch. 271	Abutments (Out Islands) Act, 1883
	Ch. 274	Abandoned Wreck Act, 1965
	Ch. 275	Merchant Shipping (Oil Pollution) Act, 1989
		Merchant Shipping (Oil Pollution) (Indemnification of Ship Owners) Regulations 1978
	Ch. 278	Water Skiing and Motor Boat Control, 1971
		Water Skiing and Motor Boat Control Regulations. 1971
	Ch. 282	Archipelagic Waters and Maritime Jurisdiction, 1996
	Ch. 283	The Bahamas Maritime Authority Act, 1995
Title XXXIII	Ch. 289	Hotel Encouragement Act, 1954
Title XLVIII	Ch. 391	The Bahamas National Trust Act, 1959
		The Bahamas National Trust (Amendment) Act 2010
		Family Islands Development Encouragement Act, No. 14, 1997
		Forestry Act, 2010
		Planning and Subdivision Act, 2010

## 5.2 International Legislation

### INTERNATIONAL AGREEMENTS TO WHICH THE BAHAMAS IS A PARTY

<p>Convention for the Unification of Certain Rules of Law Relating to Assistance and Salvage at Sea</p> <p>Protocol of 1967</p>	<p><i>Objective:</i> to provide a uniform set of rules governing assistance and salvage at sea.</p> <p><i>Concluded:</i> Brussels, 23 September, 1910</p> <p><i>In Force:</i> 1 March, 1913</p> <p><i>Concluded:</i> 27 May, 1967</p>
<p>Convention on Facilitation of International Maritime Traffic, as amended</p> <p>(FAL)</p>	<p><i>Objective:</i> to prevent unnecessary delays in maritime traffic, to aid co-operation between Governments, and to secure the highest practicable degree of uniformity in formalities and other procedures.</p> <p><i>Concluded:</i> 9 April, 1965</p> <p><i>In Force:</i> 5 March, 1967</p>
<p>International Convention on Civil Liability for Oil Pollution Damage, as amended (CLC)</p> <p>Protocol of 1992</p>	<p><i>Objective:</i> to ensure that adequate compensation is available to persons who suffer oil pollution damage resulting from maritime casualties involving oil-carrying ships; and to place liability on the owner of the ships from which polluting oil escapes or is discharged.</p> <p><i>Concluded:</i> Brussels, 29 November, 1969</p> <p><i>In Force:</i> 19 June, 1975</p> <p><i>Objective:</i> to replace the International Convention on Civil Liability for Oil Pollution Damage, 1969; to govern the liability of ship-owners for oil pollution damage; and to apply to oil pollution damage resulting from spills of persistent oil from tankers.</p> <p><i>Concluded:</i> 27 November, 1992</p> <p><i>In Force:</i> 30 May, 1996</p>

Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar)	<i>Objective:</i> to restrict the progressive encouragement on and loss of wetlands at present and in the future; to recognize the important ecological functions of wetlands and their economic, cultural,
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	<p>scientific and recreational value.</p> <p><i>Concluded:</i> 2 February, 1971</p> <p><i>In Force:</i> 21 December, 1975</p>
Convention on the International Regulations for Preventing Collisions at Sea (COLREGS)	<p><i>Objective:</i> to update and replace the International Regulations for Preventing Collisions at Sea, 1960; to maintain a high level of safety at sea.</p> <p><i>Concluded:</i> London, 20 October, 1972</p> <p><i>In Force:</i> 15 July, 1977</p>
Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)	<p><i>Objective:</i> to protect certain endangered species from over-exploitation via a system of import/export permits.</p> <p><i>Concluded:</i> 3 March, 1973</p> <p><i>In Force:</i> 1 July, 1975</p>
International Convention for the Prevention of Marine Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)	<p><i>Objective:</i> to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances.</p> <p><i>Annex I, II, III, V, VI</i></p> <p><i>Concluded:</i> 2 November, 1973 17 February, 1978</p>
Protocol of 1978 relating to the International Convention for the Safety of Life at Sea, 1974 (SOLAS)	<p><i>Objective:</i> to adopt further measures affecting tanker design and operation compatible with their safety in response to a spate of oil tanker accidents in 1976-1977.</p> <p><i>Concluded:</i> 17 February, 1978</p> <p><i>In Force:</i> 1 May, 1981</p>
United Nations Convention on the Law of the Sea (LOS)	<p><i>Objective:</i> to establish a comprehensive new legal regime for the sea and the oceans; to include rules governing environmental standards and enforcement provisions concerning pollution of the marine environment.</p>

	<p><i>Concluded:</i> Jamaica, 10 December, 1982</p> <p><i>In Force:</i> 16 November, 1994</p>
Vienna Protocol for the Protection of the Ozone Layer	<p><i>Objective:</i> to protect human health and the environment against the adverse effects resulting from human activities which modify or are likely to modify the ozone layer; and to establish protective control measures.</p> <p><i>Concluded:</i> Vienna, 22 March 1985</p>
Montreal Protocol on Substances that Deplete the Ozone Layer, as amended	<p><i>Objective:</i> to protect the ozone layer by control of the production and consumption of the most commercially and environmentally significant ozone-depleting substances.</p> <p><i>Concluded:</i> 16 September, 1987</p> <p><i>In Force:</i> 1 January, 1989</p>
Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal	<p><i>Objective:</i> to reduce trans boundary movements of wastes consistent with the environmentally sound and efficient management of such wastes; to minimize the amount and toxicity of wastes generated; and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.</p> <p><i>Concluded:</i> 22 March, 1989</p> <p><i>In Force:</i> 5 May, 1992</p>
International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC)	<p><i>Objective:</i> to assist developing countries in preparing for and responding to major oil pollution incidents (not only from ships but also from offshore oil exploration and production platforms, sea ports and oil handling facilities).</p> <p><i>Concluded:</i> London, 30 November, 1990</p> <p><i>In Force:</i> 13 May, 1995</p>

<p>International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1992 (1992 Fund Convention)</p>	<p><i>Objective:</i> to supplement the International Convention on Civil Liability for Oil Pollution Damage, 1969; to ensure that adequate compensation is available to persons who suffer damage caused by pollution resulting from the escape or the discharge of oil from ships; and to ensure that the oil cargo interests bear a part of the economic consequences of such oil pollution damage, to the relief of the shipping industry.</p>
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	<p><i>Concluded:</i> London, 1992</p> <p><i>In Force:</i> 30 May, 1996</p>
United Nations Framework Convention on Climate Change	<p><i>Objective:</i> to achieve stabilization of greenhouse gases at a low level in the atmosphere in order to prevent dangerous anthropogenic interference with the climate system.</p> <p><i>Concluded:</i> New York, 9 May, 1992</p> <p><i>In Force:</i> 21 March, 1994</p>
Convention on Biological Diversity	<p><i>Objective:</i> to develop national strategies for the conservation and sustainable use of biological diversity.</p> <p><i>Concluded:</i> Rio de Janeiro, 5 June, 1992</p> <p><i>In Force:</i> 29 December, 1993</p>
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	<p><i>Objective:</i> to fight desertification and minimize the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.</p> <p><i>Concluded:</i> Paris, 14 October, 1994</p> <p><i>In Force:</i> 26 December, 1996</p>
Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks	<p><i>Objective:</i> to encourage cooperation between States to ensure conservation and promote the objective of optimum utilization of fisheries resources both within and beyond the exclusive economic zone.</p> <p><i>Concluded:</i> 4 December, 1995</p> <p><i>In Force:</i> 11 December, 2001</p>
Kyoto Protocol to the United Nations Framework Convention on Climate Change (Not yet in force)	<p><i>Objective:</i> to reduce greenhouse gas emissions by enhancing the national programs of developed countries concerned with this goal and by establishing percentage reduction targets for the such countries.</p> <p><i>Concluded:</i> 16 March, 1998</p> <p><i>Signed:</i> 9 April, 1999</p>
Stockholm Convention on Persistent Organic Pollutants (Not yet in force)	<p><i>Objective:</i> to protect human health and the environment from persistent organic pollutants.</p>

	<p><i>Concluded:</i> 22 May, 2001</p> <p><i>Signed:</i> 20 March, 2002</p>
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### 5.3 Government Institutions

Little Harbour falls within the jurisdiction of the Central Abaco Magisterial district and currently represented by the South Abaco Member of Parliament, Mr. Edison Key, M.P. Other governmental organizations are:

- Road Traffic Department
- Department of Agriculture & Fisheries
- Port Department
- Public Works and Transport
- Bahamas Telecommunications Company (Batelco)
- Bahamas Electricity Corporation
- Bahamas Air Division
- Water and Sewage Department
- Business Licensing Department
- Hotel Licensing Board
- Tourism Advisory Board
- Town Planning Committee
- Ministry of Tourism Department
- Department of Environmental Health
- Bahamas Customs Department
- Bahamas Immigration Department
- Bahamas Mortgage Corporation
- Department of Local Government and Island Administration
- Department of Public Health
- Department of Social Services
- Ministry of Housing and Social Development
- The National Insurance Board
- Royal Bahamas Police Force
- Civil Aviation Department
- Ministry of the Environment
- Bahamas Environment, Science, and Technology Commission
- Antiquities, Monuments, and Museums Corporation
- Bahamas National Trust (BNT) (NGO)

## **6 ENVIRONMENTAL IMPACT ANALYSIS**

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### **6.1 Impact Assessment Methodology**

Impacts were assessed through field data collection and desktop analysis. Methodologies included a review of aerial photography and Site conceptual plans; data gathering and ground-truthing for vegetation surveys; historical research, a review of scientific literature, government reports, and socio-economic research.

These resources aided in the decision making process to determine the impacts of the proposed Development Plan on Little Harbour. Dredging was initially considered but later a no dredge decision was arrived at to avoid impacts where possible through an exploration of alternatives and an elimination process according to parameters such as environmental constraints, environmental impacts, feasibility costs, and construct ability.

### **6.2 Land Use Impacts**

The minor modifications to the upland are considered to be minimal, the existing footprint is to be considered humanly disturbed.

### **6.3 Visual and Aesthetic Impacts**

Little Harbour may be considered an aesthetic settlement due to its location and topography. The style of architecture may be considered to be typically vernacular in nature. The surrounding dune ridge provides numerous vantage points with views to the sea.

Visual and aesthetic impacts are considered neutral, if not slightly negative due to the additional boat slip spaces, these however are in keeping with existing use of Little Harbour and typical of the Family Island settlements. The removal of invasive species and the replacement with native species will improve the aesthetics of the upland development.

Except where necessary for dock construction, foreshore and shoreline will remain natural. Landscaping will be utilized throughout the Site for beautification purposes with emphasis on native species

tolerant to high salt, sun, and low water conditions.

## **6.4 Impacts to the Physical Environment**

Cumulative physical terrestrial impacts are not considered to be of any significance, though the removal of invasive and pioneer species are to be considered positive.

Weather and climate are environmental factors that will persist throughout the development period, and as such the developer shall take into consideration the impacts from anticipated and unexpected weather events that may naturally impact the physical environment.

The proposed development seeks to avoid undue environmental harm where possible. Mitigation techniques and best management practices to mitigate and alleviate adverse impacts are outlined in Section 7.

### **6.4.1 Coastal and Oceanographic Impacts**

Impacts to the near shore environment are anticipated to be minimal. Any impacts, namely displacement of sand for pile insertion, due to dock construction will be minimal and short-term. The implementation of a dock may positively impact the coast whereby visiting boats will have access to adequate dockage rather than navigate unfamiliar shallow waters and potentially, disturb marine biota with prop wash.

### **6.4.2 Hydrologic Impacts**

Excluding the salt water table, no significant subterranean fresh water lens is known to exist at the Site that would be otherwise affected by the project.

No site specific hydrological studies have been conducted nor is it presumed that they will be required as the minimal land mass of the Site would not accumulate nor develop any fresh water lens of any magnitude. Hydrologic impacts refer to harmful substances released into surface or ground waters either directly or indirectly and these cause change to surface and sub-surface water flows.

The primary cause of surface water impacts result from run-off from roads and car parks, subsurface groundwater may be impacted by these run-offs but are subject to pollution from poorly installed or maintained drains sewers and the like. The results are concentrated run-off, increased flooding, loss of wetlands, shoreline modifications and loss of unique natural features and aesthetic losses.

#### 6.4.2.1 *Erosion and Sediments Impacts*

Erosion and sediment impacts are limited to activities associated with preparation for construction and supporting infrastructure, i.e. back of house. Other potential erosion and sediment impacts such as site grading and excavation for foundation setting fall under the auspice of an environmental management plan.

The Site is previously humanly disturbed and with very limited additional upland construction there will be no erosional or sediment impacts from upland activities.

#### 6.4.2.2 *Stormwater Management*

The only proposed upland development is to be the construction of a car port. The nature of the structure and the photovoltaic array as a roof will not add significantly to stormwater runoff.

Any run off from this structure can be managed within the existing footprint by adequate landscaping. Run off from the roof of the exiting two storey structure is collected for re-use.

#### 6.4.3 *Air Quality Impacts*

No long-term adverse air quality impacts are to be anticipated. The development will result in a minor, but insignificant, decrease in air quality due to the increase of watercraft traffic but does necessitate air quality testing.

#### 6.4.4 *Noise Quality Impacts*

No long-term adverse noise impacts are to be anticipated. Temporary noise impacts may occur during development construction due to construction activities. This issue is temporary and expected to dissipate upon development completion. Table 6.4.4 contains estimated noise levels to be anticipated during construction.

Equipment	Levels in dBA at 50 feet <sup>a</sup>
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Front Loader	73-86
Trucks	82-95
Cranes (moveable)	75-88
Cranes (derrick)	86-89
Vibrator	68-82
Saws	77-82
Pneumatic Impact Equipment	83-88
Jackhammers	81-98
Pumps	68-72
Generators	71-83
Compressors	75-87
Concrete Mixers	75-88
Concrete Pumps	81-85
Back Hoe	73-95
Pile Driving (peaks)	95-107
Tractor	77-98
Scraper/Grader	80-93
Paver	85-88
<sup>a</sup> Machinery equipped with noise control devices or other noise-reducing design features does not generate the same level of emissions as that shown in this table.	
Source: EPA, <i>Noise from Construction Equipment and Operations, Building Equipment and Home Appliances</i> , PB 206717, 1971.	

#### 6.4.5 Fire and Hurricane Risks

##### Fire

All buildings associated with the development will comply with all fire requirements of The Bahamas Building Code, thus minimizing to the extent possible all fire-associated risks. There are, however, no current or intended municipal fire services and the developer will provide this service at his discretion.

##### Hurricane

The Bahamas are subject to hurricanes generally between June 1 and November 30, though tropical

disturbances have formed outside the given Hurricane Season. The greatest risk for a hurricane strike occurs between August and October. The most destructive hurricanes in recent years have Andrew (1992), Lili (1996), Floyd (1999 with winds of 155mph), Michelle (2001), Frances (2004 with winds of 140 mph), Jeanne (2004), Rene (2011) and hurricane Sandy in 2012.

Hurricanes bring tremendous quantities of rain, often 25% of the annual average which would easily overwhelm a natural or installed drainage system. Storm water drainage across the Bahamas is notoriously inadequate and intense rain storms produce severe flooding in localized areas very quickly.

Little Harbour's greatest exposure to hurricane wave impacts is at the entrance where storm surge in catastrophic weather events is reported to reach storm surge heights of six feet over normal tide events.

Extensive flooding can occur in low-lying coastal areas from storm surges caused by extreme low barometric pressures when the ocean sometimes rises as much as 12 to 17 ft. The rising sea destroys onshore structures as seawater surges onto shore and then rushes back to the ocean as the storm passes. The beach may incur significant changes including erosion or accretion depending on the intensity, direction, and length of storm. Sea structures may be weakened or damaged after days of intense wave action.

The member's docking facility should maintain a hurricane contingency plan to secure all physical buildings and their contents, evacuation protocols, and emergency and health provisions.

All construction standards will be in compliance with the Bahamas Building Code 3<sup>rd</sup> Edition. New structures will be built to endure winds of up to 140 miles per hour as per the hurricane construction standards of the Bahamas Building Code 3<sup>rd</sup> Edition. Hurricane watches and warnings will provide advance notice to construction workers and residents for preparations and evacuations.

## **6.5 Biological Impacts**

Biological impacts associated with upland buildings and ancillary features are considered negligible due to prior human habitation. There will be no loss of vegetation, and the removal of invasive species will allow for the reintroduction of native species.

### **6.5.1 Habitat Fragmentation Impacts**

Habitat fragmentation impacts are negligible due to the site being previously disturbed. Marine habitat fragmentation is not anticipated due the fact that no dredging activities are to be undertaken. The dock structure is not likely to impede species mobility.

### 6.5.2 Habitat Degradation

Habitat degradation impacts are considered minimal to moderate. The removal of invasive species reduces the potential for future habitat degradation. Degradation of marine habitat is considered minimal and localized. Some degradation of sea grasses is anticipated and unavoidable for piling and likely to recolonize upon completion.

### 6.5.3 Impacts on Special Ecological Features and Biodiversity

Biodiversity at Little Harbour is likely limited due to its small land mass as smaller land masses tend to support fewer numbers of species than larger ones. There are no special ecological features of note at the site.

## 6.6 Socio-economic Impacts

Socio-economic impacts are considered positive. Capital investment is to be seen in the positive and the creation of economic activity and construction jobs for Bahamians are similarly positive.

Impacts to neighboring communities were also considered positive with on-going maintenance needs, transportation and provisioning to require local services.

## 6.7 Waste Stream Impacts

### 6.7.1 Solid and Hazardous Waste Impacts

Little to no hazardous waste impacts are anticipated on the Site and few hazardous materials will be utilized for construction or operational activities at the property.

Solid waste during construction will be disposed of in a centrally located staging area which will be disposed of on an 'as required' basis to the waste staging facility at the settlement in Cherokee.

An emergency spill plan is recommended to be in place during construction activity. This plan should provide training for staff and methods of cleanup in the case of an incident.

### 6.7.2 Water and Wastewater Impacts

No impacts are anticipated from the operational phases of the members docking facility, which will continue in the same manner as currently exists.

## **6.8 Cultural Resources Impacts**

No impacts to cultural resources were identified during this study. The site, having been previously developed or occupied, is therefore excluded from specific Cultural, archaeological or historic resources studies.

## **7 PROPOSED MITIGATION MEASURES**

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Removal of invasive species. This EIA strongly recommends phased removal of all invasive and pioneer species on site by the developer. To maintain the site as exotic-free once invasive species are removed, a long-term maintenance program is necessary. Periodic removal of *Casuarina equisetifolia* saplings from beach areas and undeveloped parcels will assist in preventing the reestablishment of these species.

Native landscaping. Landscape design should incorporate indigenous plant material. Indigenous species are tolerant to the stresses of a coastal tropical climate and act as resource for food or habitat to local animal species. Use of indigenous plants will help to reduce water demand, particularly those species with drought-tolerance. Native plant species, particularly fruiting shrubs and trees, provide a source of food for resident and migrant avifauna species.

## **8 ENVIRONMENTAL MANAGEMENT PLAN**

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An Environmental Management Plan (EMP) will be drafted following review and return comments received from the BEST Commission.

## **9 PUBLIC CONSULTATION**

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Public consultation with relevant stakeholders may facilitate good relations and subsequently, deter the potential for future conflict. Request for public consultation, if necessary, may be mandated by the government and facilitated by the government and the developer following receipt of return comments from The BEST Commission.

## **10 CONCLUSION**

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This Environmental Impact Assessment for Members docking facility on Little Harbour recommends moving forward with the proposed development and finds no significant impact. The site will experience no loss of vegetation; however, implementation of mitigation techniques such as native landscaping and removal of invasive species shall lessen overall impacts.

Additionally, the capital investment will positively impact the local community of Little Harbour by providing employment and occupational transfer of skills while expanding the touristic offerings of Little Harbour. The developer emphasizes a local Bahamian workforce with minimal environmental impacts through the use of renewable energy technology, smart building design, and high efficiency products.

## 11 RECOMMENDATIONS

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The following recommendations are based on the assessment of impacts, short-term and long-term, to this project site at Little Harbour. The proposed recommendations include:

- a) Environmental Management Plan (EMP). An EMP will be prepared as a separate document. The developer should employ best management practices during construction activities including practices that prevent erosion and sediment runoff, ensure proper material storage and disposal, and monitoring of construction of activities during pile installation. As no dredging will be required for safe passage to the proposed dock, best management practices for the management of suspended sediment shall be included.
- b) Removal of invasive species. This EIA strongly recommends phased removal of all *invasive and pioneer* species on site by the developer. To maintain the site as exotic-free once invasive species are removed, a long-term maintenance program is necessary. Periodic removal of *Casuarina equisetifolia* saplings from beach areas and undeveloped parcels will assist in preventing the reestablishment of these species.
- c) Limited construction footprint. Given the site's low acreage and humanly impacted environment, limited clearing beyond that which exists is recommended.
- d) Native landscaping. Landscape design should incorporate indigenous plant material. Indigenous species are tolerant to the stresses of a coastal tropical climate and act as resource for food or habitat to local animal species. Use of indigenous plants will help to reduce water demand, particularly those species with drought-tolerance. Native plant species, particularly fruiting shrubs and trees, provide a source of food for resident and migrant avifauna species.
- e) Alternative Energy Sources. Little Harbour is ideal for the introduction of alternative sources, namely, passive solar and photovoltaic array. It is recommended that conventional energy sources, diesel and gas, be supplemented by alternative energy sources or achieved by high efficiency standards.
- f) Reduction of waste and land-based pollution. Limiting the production of land-based waste through recycling, composting, and incineration, reduces the transportation of waste items to local landfills which are under capacity pressure.

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